Compact Telescoping Array Design and Development, Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

Solar arrays power the vast majority of space missions. Solar arrays with higher power, better mass efficiency and improved packaging are critical, especially given NASA interest in solar electric propulsion (SEP). The Phase I results shows that the Compact Telescoping Array (CTA) architecture, originally conceived by a NASA sponsored team, is a very promising new technology. Not only has CTA shown outstanding performance metrics, but it does so in a manner that is scalable, reliable and offers compact stowage. The proposed innovation is a solar array design consisting of a single central truss structure flanked by tensioned flexible photovoltaic blankets. This configuration has been shown in multiple analytical studies to be the most mass efficient for a cantilevered solar array. Phase I results confirm that CTA has very low structural mass which, with state-of-practice cell technology, allows the platform to deliver excellent specific power. For example, sub-200 kW systems show specific power approaching 190 W/kg and mega-Watt versions of CTA still produce better than 150 W/kg. The CTA stowed wing achieves the ?compact? attribute due to the fact that the two primary components of the system, the boom and the PV blankets, though by different methods, both stow into highly volume-efficient packages. The individual boom segments all nest neatly inside one another while the PV blankets stow into compact Z-folded stacks. The result is a system that is capable of delivering compactness in excess of 100 kW/m?, far beyond expectations. The CTA system, although a new solar array configuration, is shown through Phase I research to have high reliability. This is achieved by leveraging heritage mechanical subsystems and by minimizing new mechanism design, thereby effectively delivering a higher TRL than would ordinarily be associated with a new system. The CTA design draws heavily from heritage designs of Angstrom Designs subcontractor Orbital ATK Goleta.

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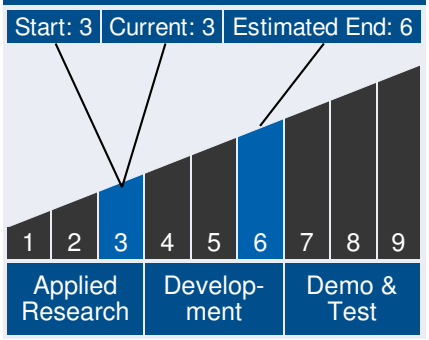
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

Continued on following page.

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ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: Potential CTA Phase II and Phase III SBIR contracts will build demonstration units representing 17 and 30 kW systems respectively. This will advance CTA technology to TRL 6. Increasing power level step by step advances CTA technology toward larger systems by taking advantage of the natural scalability of the CTA platform. This will bring SEP power class systems 50 kW and higher well within reach. NASA programs involving large solar arrays would be particularly interested in this technology development path as it directly supports mass-critical SEP mission requirements. The Asteroid Redirect Mission (ARM) is one relatively near term NASA mission that could benefit from CTA. Following Phase II and Phase III work, Angstrom Designs expects applications should be in the form of purchase contracts with our subcontractor and commercialization partner, Orbital ATK, to supply ARM or other NASA missions with efficient space power. Phase I results show that a CTA system could supply 50 kW for a potential ARM SEP mission delivering metrics of 190 W/kg specific power and 88 kW/m? power density. A future Mars cargo SEP mission could be fitted with 190 kW of CTA power with outstanding metrics: 187 W/kg and 98 kW/m?. Versatile packaging, exceptional performance and solid reliability over a wide range of power classes and g-loads all indicate that the CTA platform lends itself well to future NASA missions.

To the commercial space industry:

Potential Non-NASA Commercial Applications: CTA is primarily the combination of flight-qualified components so the design is inherently lower risk than completely new arrays. After successful completion of the Phase II work, including building and testing a CTA wing, risk will be further reduced and the TRL of CTA will be significantly advanced. Phase II work will further reduce development costs and risks of future programs. CTA?s exceptional metrics and packaging versatility are also of great

Management Team *(cont.)*

Principal Investigator:

- Peter Sorensen

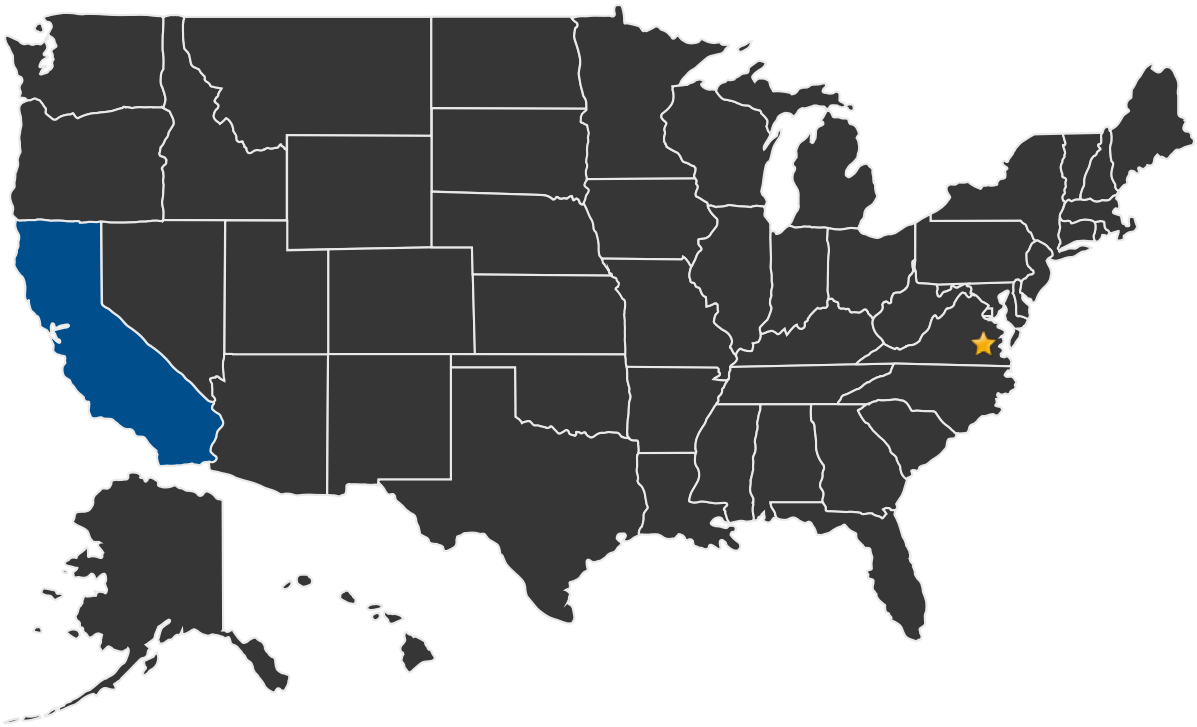
Technology Areas

Primary Technology Area:
Materials, Structures, Mechanical Systems and Manufacturing (TA 12)

- Structures (TA 12.2)
  - Lightweight Concepts (TA 12.2.1)

benefit to the non-NASA, commercial market. Phase II work will advance technology and lower risk to enable commercial infusion beyond NASA. Commercial satellite enterprises will be able to reap the benefits of reduced solar array mass in the form of increased payload capacity and/or reduced launch costs. CTA is also an excellent candidate for the advanced arrays needed for GEO-Comm satellites to take advantage of the cost benefits of using SEP and dual launch. The Phase II demonstrator CTA wing will be representative of a 17 kW system, a power level of interest to the suppliers in the GEO-Comm market. At least two suppliers of commercial satellites, Boeing and Orbital ATK, are currently seeking to replace rigid panel technology with flexible blanket systems in near term programs. Other high probability customers include the department of Defense, Air Force Research Laboratory and foreign governments all of whom have an interest in high power, low mass, low risk, low cost solar arrays.

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Langley Research Center

Other Organizations Performing Work:

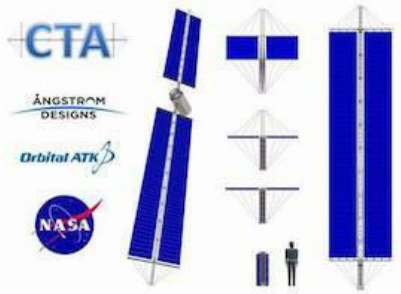
- Angstrom Designs, Inc. (Santa Barbara, CA)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23441)

IMAGE GALLERY



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DETAILS FOR TECHNOLOGY 1

Technology Title

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